

What is claimed is:

1 1. A method comprising:
2 using a four-membered ring of alternating
3 nitrogen and silicon atoms as a silicon precursor to form a
4 silicon nitride film.

1 2. The method of claim 1 further including using a
2 nitrogen precursor to form a silicon nitride film.

1 3. The method of claim 1 further including using
2 said silicon precursor at a temperature less than
3 approximately 500°C.

1 4. The method of claim 1 including using a four-
2 membered ring comprising the general formula:
3 $[R_2SiNR]_2$,
4 where each R is selected from the group
5 consisting of a hydrogen, a halogen, an amine, an alkyl, an
6 aryl, a silyl and an organic group having one to
7 approximately twenty carbons.

1 5. The method of claim 1 including using a
2 halogenated cyclodisilazane.

1 6. The method of claim 1 including using an amine
2 substituted cyclodisilazane.

1 7. The method of claim 1 including using
2 cyclodisilazane including an organic group containing one
3 to approximately 20 carbon atoms.

1 8. The method of claim 2 including using a nitrogen
2 precursor selected from the group consisting of ammonia,
3 hydrazine and a substituted hydrazine.

1 9. The method of claim 2 including combining said
2 nitrogen precursor and said silicon precursor in a premixed
3 cocktail with an optional solvent.

1 10. The method of claim 1 including forming a silicon
2 nitride film tuned to have a specific impurity profile.

1 11. A method comprising:
2 using a silicon precursor to form a silicon
3 nitride film, said silicon precursor being a substituted
4 ring comprising the general formula:

5 $(\text{Si})_a(\text{N})_{2a},$

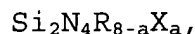
6 where silicon is bound to two nitrogens,

7 where said nitrogens are bound to said silicon
8 and nitrogen, and

9 where a is an integer greater than or equal to
10 one.

1 12. The method of claim 11 including using 1,2,4,5-
2 tetraaza-3,6-disilacyclohexane as the silicon precursor.

1 13. The method of claim 11 including using a silicon
2 precursor comprising the general formula:



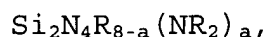
4 where X is a halogen,

5 where each R is selected from the group
6 consisting of a hydrogen, a halogen, an amine, an alkyl, an
7 aryl, a silyl and an organic group having one to
8 approximately twenty carbons, and

9 where a is an integer less than or equal to
10 eight.

1 14. The method of claim 11 including using a
2 halogenated derivative of 1,2,4,5-tetraaza-3,6-
3 disilacyclohexane as the silicon precursor.

1 15. The method of claim 11 including using a silicon
2 precursor comprising the general formula:



4 where each R is selected from the group
5 consisting of a hydrogen, a halogen, an amine, an alkyl, an
6 aryl, a silyl and an organic group having one to
7 approximately twenty carbons, and

8 where a is an integer less than or equal to four.

1 16. The method of claim 15 including using a silicon
2 precursor selected from the group consisting of 3,6-
3 bis(dimethylamino)-1,4-ditertiarybutyl-2,5-dimethyl-
4 1,2,4,5-tetraaza-3,6-disilacyclohexane and 3,6-
5 bis(tertiarybutylamino)-1,4-ditertiarybutyl-1,2,4,5-
6 tetraaza-3,6-disilacyclohexane.

1 17. The method of claim 11 including using a silicon
2 precursor comprising the general formula:



4 where each R is selected from the group
5 consisting of a hydrogen, a halogen, an amine, an alkyl, an
6 aryl, a silyl and an organic group having one to
7 approximately twenty carbons.

1 18. The method of claim 17 including using a silicon
2 precursor selected from the group consisting of 1,2,4,5-
3 tetratertiarybutyl-1,2,4,5-tetraaza-3,6-disilacyclohexane,
4 3,6-divinyl-1,4-ditertiarybutyl-2,5-dimethyl-1,2,4,5-
5 tetraaza-3,6-disilacyclohexane, 3-phenyl-1,4-
6 ditertiarybutyl-1,2,4,5-tetraaza-3,6-disilacyclohexane,
7 1,2,4,5-tetramethyl-1,2,4,5-tetraaza-3,6-disilacyclohexane,
8 and 1,2,3,3,4,5,6,6-octamethyl-1,2,4,5-tetraaza-3,6-
9 disilacyclohexane.

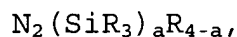
1 19. The method of claim 11 further including using a
2 nitrogen precursor selected from one of ammonia, a
3 hydrazine or a substituted hydrazine.

1 20. The method of claim 19 further including
2 combining said silicon precursor and said nitrogen
3 precursor in a premixed cocktail with an optional solvent.

1 21. The method of claim 11 further including forming
2 said silicon nitride film at a temperature less than
3 approximately 500°C.

1 22. A method comprising:
2 combining a silicon source precursor comprising
3 hydrazine including at least two silyl substitutions and a
4 nitrogen precursor; and
5 forming a silicon nitride film.

1 23. The method of claim 22 including combining a
2 silicon source precursor comprising the general formula:



4 where each R is selected from the group
5 consisting of a hydrogen, a halogen, an amine, an alkyl, an
6 aryl, a silyl and an organic group having one to
7 approximately twenty carbons, and
8 a is two, three, or four.

1 24. The method of claim 22 including combining a
2 silicon source precursor selected from the group consisting
3 of 1,2-disilylhydrazine, 1,1,2-trisilylhydrazine, 1,1,2,2-
4 tetrasilylhydrazine, 1,2-bis(trimethylsilyl)-1,2-
5 ditertiarybutylhydrazine and 1,2-bis(trimethylsilyl)-1,2-
6 diphenylhydrazine.

1 25. The method of claim 22 including combining said
2 silicon source precursor and a nitrogen precursor from the
3 group consisting of ammonia, hydrazine and a substituted
4 hydrazine.

1 26. The method of claim 25 further including
2 premixing said silicon source precursor and said nitrogen
3 precursor in a cocktail with an optional solvent.

1 27. The method of claim 22 including tuning said
2 silicon nitride film to have a desired impurity profile.

1 28. The method of claim 22 further including heating
2 a deposition reaction chamber to a temperature that is less
3 than approximately 500°C.

1 29. A system comprising:
2 a chamber; and
3 a silicon source coupled to said chamber, said
4 silicon source for use as a silicon precursor selected from
5 the group consisting of a four membered ring of alternating
6 silicon and nitrogen atoms, a silyl substituted hydrazine
7 comprising at least two silyl substitutions, and a compound
8 having a substituted ring comprising the general formula:
9 $(\text{Si})_a(\text{N})_{2a}$,
10 where silicon is bound to two nitrogens,
11 where said nitrogens are bound to said silicon
12 and nitrogen, and
13 where a is an integer greater than or equal to
14 one.

1 30. The system of claim 29 further including a
2 nitrogen source for a nitrogen precursor coupled to said
3 chamber.

1 31. A silicon precursor comprising a four-membered
2 ring of alternating silicon and nitrogen atoms, said
3 silicon precursor combined with a nitrogen precursor in a
4 chemical vapor.

1 35. A silicon precursor comprising a hydrazine
2 including at least two silyl substitutions, said silicon
3 precursor combined with a nitrogen precursor in a chemical
4 vapor.

1 36. The silicon precursor of claim 35 wherein said
2 hydrazine includes the general formula:

3
$$\text{N}_2(\text{SiR}_3)_a\text{R}_{4-a},$$

4 where each R is selected from the group
5 consisting of a hydrogen, a halogen, an amine, an alkyl, an
6 aryl, a silyl and an organic group having one to
7 approximately twenty carbons, and
8 a is two, three, or four.